

Oct. 20, 1925.

J. V. GIESLER

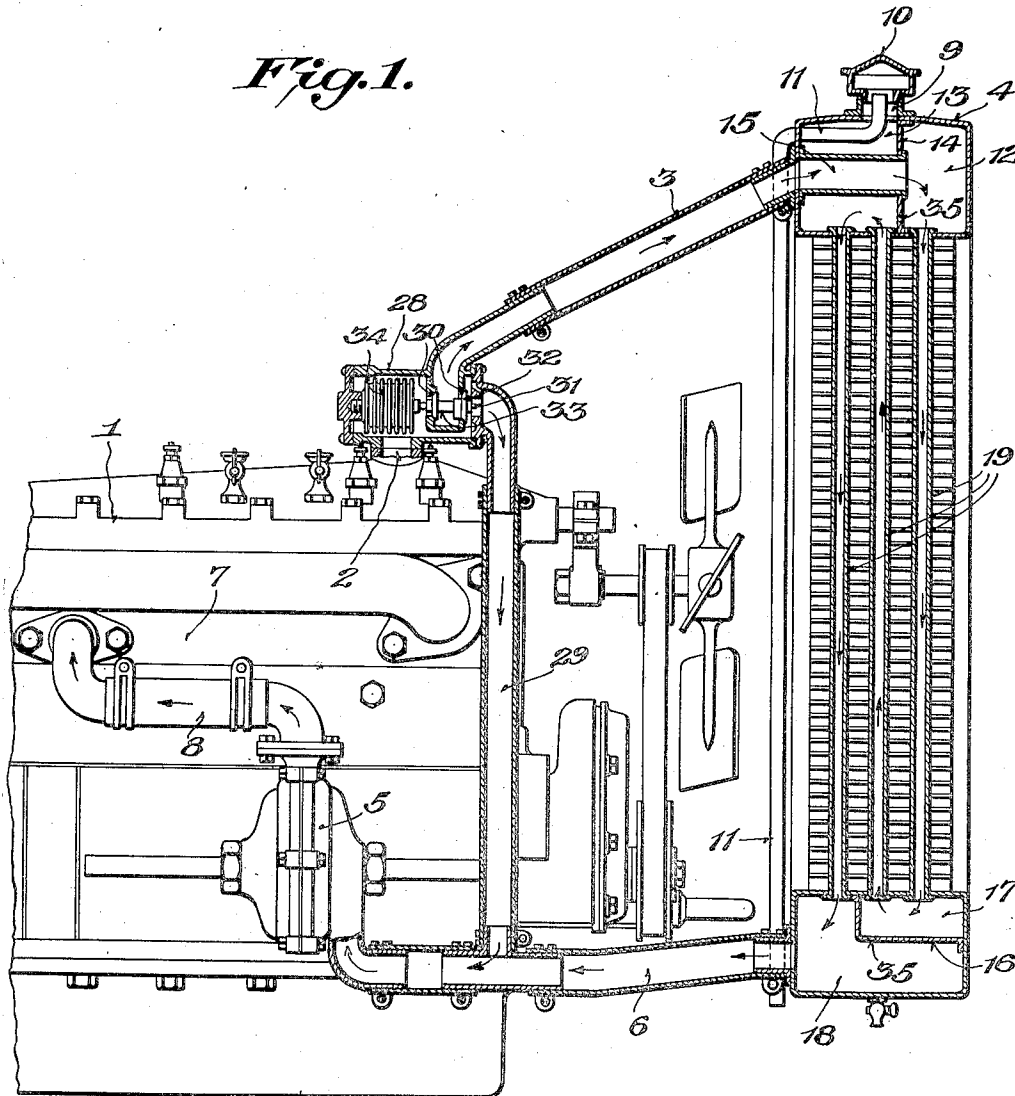
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COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES

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6 Sheets-Sheet 1.

Fig. 1.



Witness

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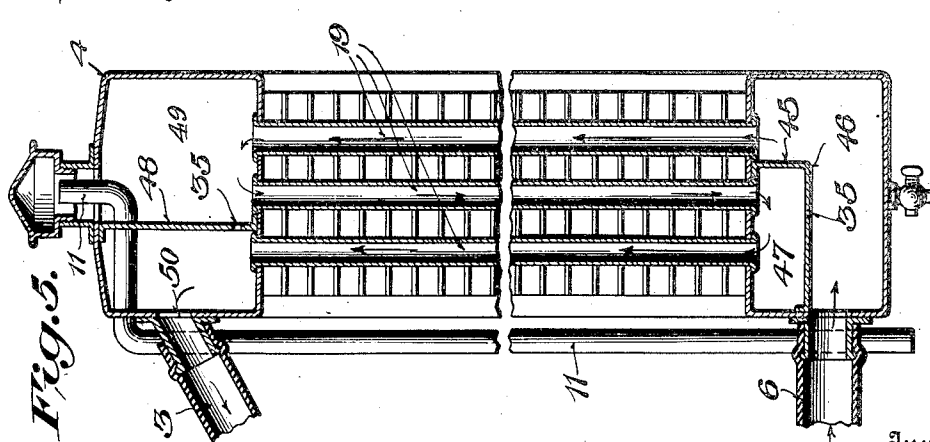
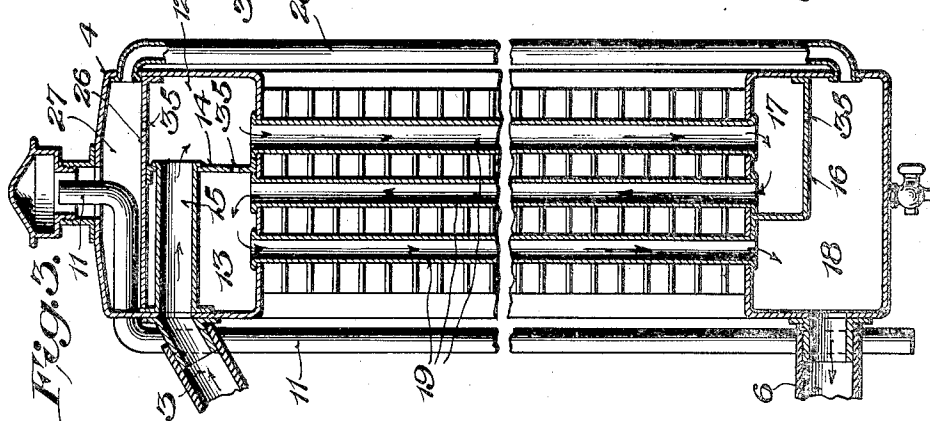
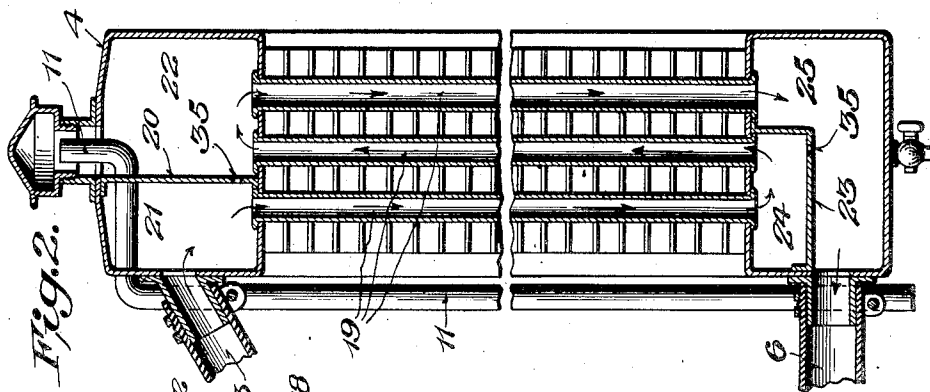
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6 Sheets-Sheet 2



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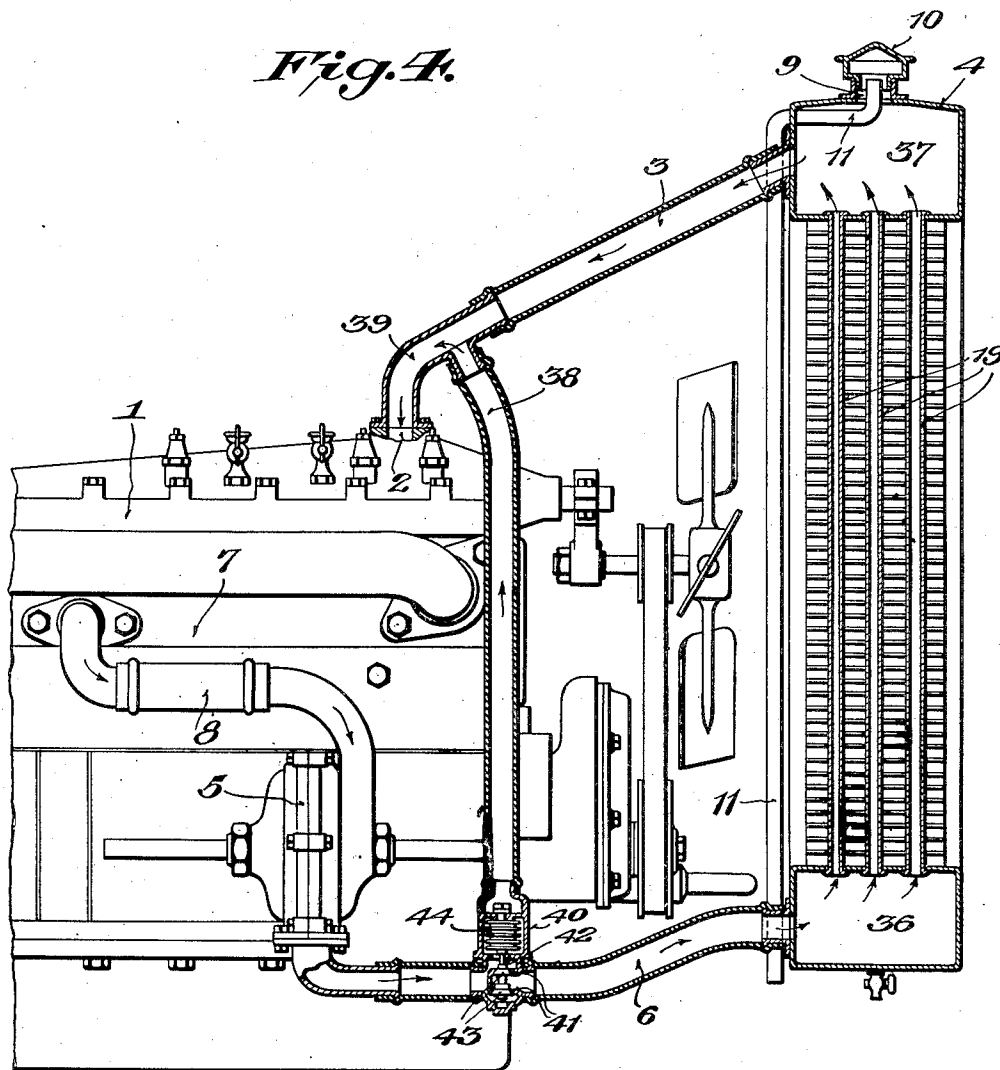
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COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES

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6 Sheets-Sheet 3

Fig. 4.



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1,558,009

COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES

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Fig. 6.

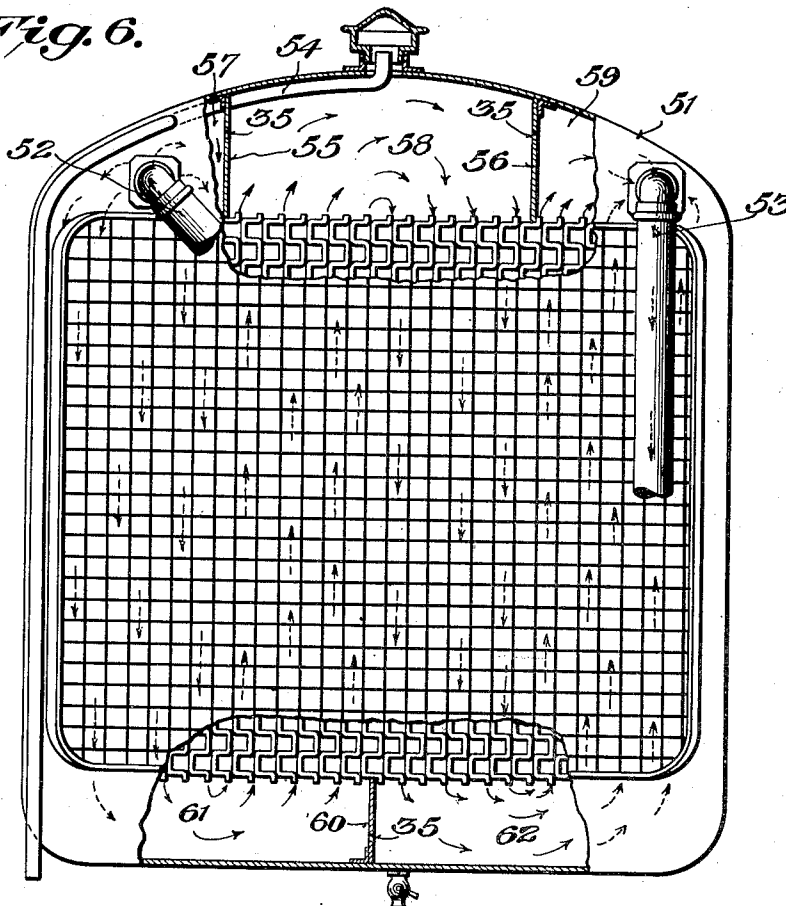
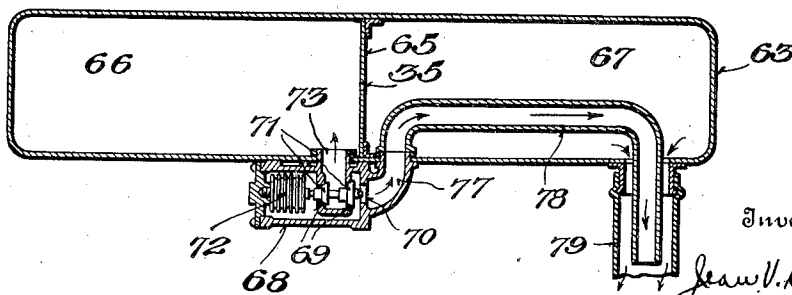


Fig. 9.



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Oct. 20, 1925.

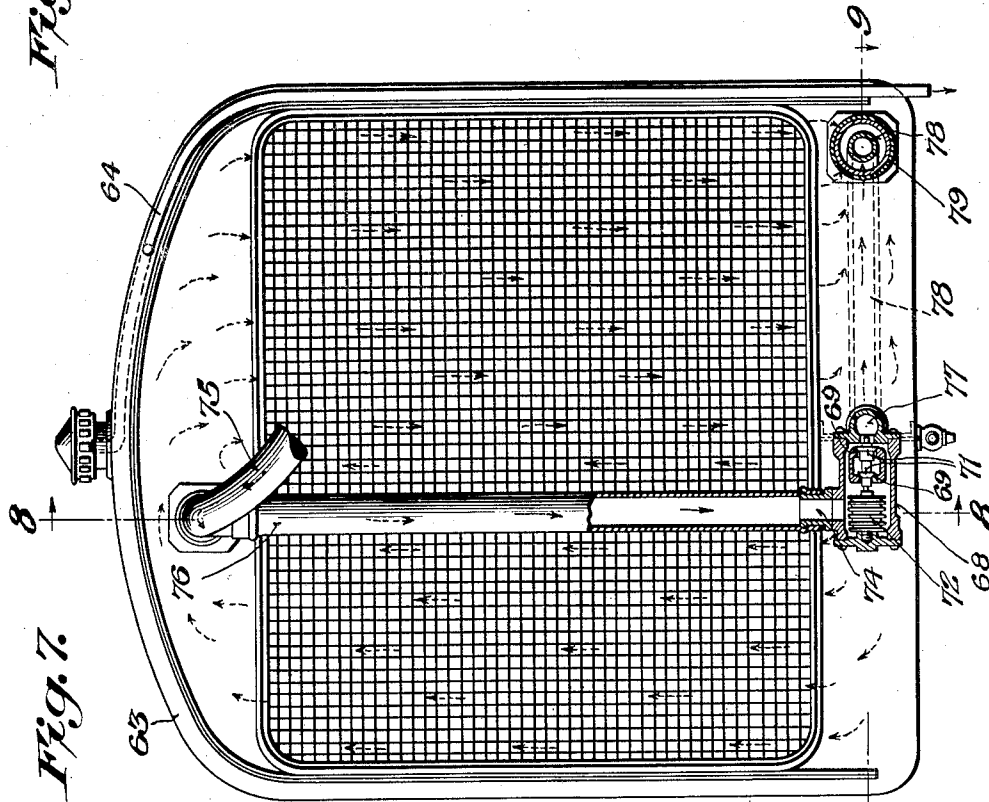
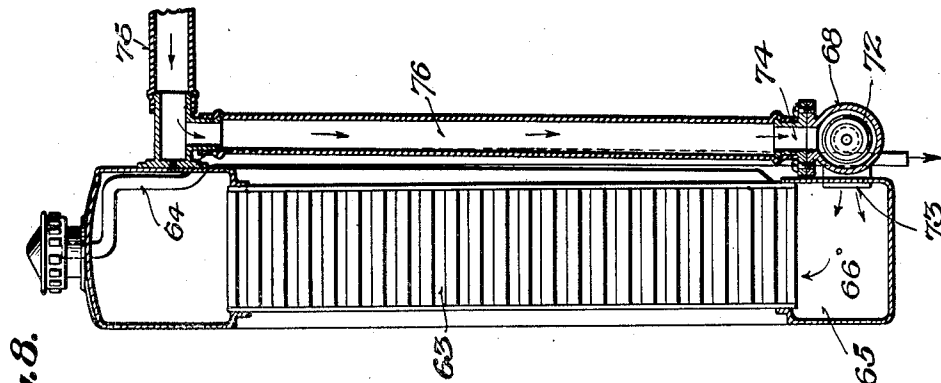
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COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES

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6 Sheets-Sheet 5



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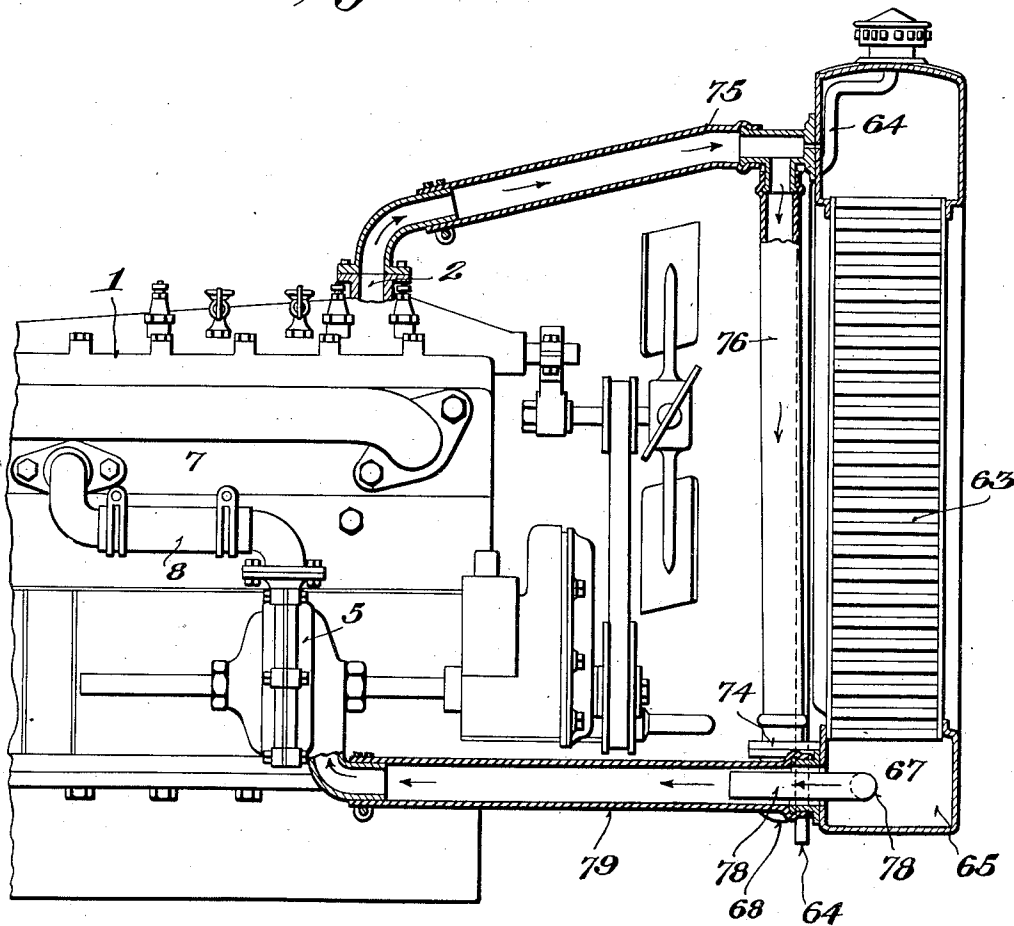
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COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES

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6 Sheets-Sheet 6

Fig. 10.



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UNITED STATES PATENT OFFICE.

JEAN V. GIESLER, OF KNOXVILLE, TENNESSEE, ASSIGNOR TO THE FULTON COMPANY,
OF KNOXVILLE, TENNESSEE, A CORPORATION OF MAINE.

COOLING SYSTEM FOR INTERNAL-COMBUSTION ENGINES.

Application filed October 20, 1919. Serial No. 331,893.

To all whom it may concern:

Be it known that I, JEAN V. GIESLER, a citizen of the United States, and a resident of Knoxville, Tenn., have invented new and useful Improvements in Cooling Systems for Internal-Combustion Engines, which invention is fully set forth in the following specification.

This invention relates to cooling systems for internal combustion engines and, while capable of use with a variety of engines of this type, is of particular utility when applied to the cooling systems of engines for automobiles, tractors, airplanes etc.

In order to prevent the water or other cooling medium from freezing in the radiator of a cooling system for an internal combustion engine, it is customary to supply the cooling medium with an anti-freezing constituent, and this is true even though the radiator is provided with a protective covering, shutters or other means for retarding the cooling of the radiator when the engine is not running. The preferred anti-freezing compositions, and those which are most commonly used, such as alcohol, are not only volatile by nature but have a boiling point appreciably lower than the boiling point of water. Consequently there is a tendency for such anti-freezing composition to fractionally distill off when the cooling medium is heated to a relatively high temperature in passing through the engine cylinder. Moreover, it is customary to provide the radiator with an overflow or vent opening adjacent the top thereof and, as it is also customary to conduct the cooling medium from the engine jacket to the upper part of the radiator before subjecting the same to the cooling influence of the radiating surfaces, any vapor that may be formed in the cooling medium as it passes through the engine jacket may readily escape through such overflow or vent opening and thereby become lost. This necessitates the frequent replenishment of the cooling compound with the attendant care and expense.

To obviate this difficulty, it has been suggested to lead such vapor through a condenser pipe or coil and collect the condensed liquid for re-supply to the cooling medium. Such devices, however, do not obviate the necessity of close attention to the condition of the cooling medium to insure that there

is an adequate supply of the anti-freezing constituent therein and, moreover, such devices materially add to the size and cost of the cooling system.

It is an object of this invention to provide a cooling system for an internal combustion engine which comprises an improved radiator constructed to insure against the escape of vapor formed during the passage of the cooling medium through the engine jacket without the provision of auxiliary condensing and liquid-collecting apparatus.

It has heretofore been suggested to provide a cooling system for an internal combustion engine with means which act automatically to normally maintain the temperature of the cooling medium substantially at a pre-determined temperature when the engine is running, such temperature being selected approximately at that degree at which the engine operates most efficiently. As the quality of fuel oils becomes poorer, however, the temperature at which the engine operates most efficiently rises. Therefore, the provision of means in the cooling system for normally maintaining the temperature of the cooling medium at that relatively high degree at which the engine operates most efficiently has been opposed because, at such temperature, the anti-freezing constituent is rapidly distilled off with the result that the cooling medium is left in a condition wherein it may readily freeze in the radiator when the engine is stopped.

It is an object of this invention to provide a cooling system for an internal combustion engine with means whereby the cooling medium is maintained substantially at a pre-determined temperature when the engine is running and a radiator so constructed as to insure against or minimize the loss of the cooling medium or any of its constituents by vaporization.

A further object of this invention is to provide a radiator unit for the cooling system of internal combustion engines which is so constructed as to insure against loss of vapor from the cooling medium and which has formed unitarily therewith means whereby the cooling medium may be maintained substantially at a pre-determined temperature.

A further object of the invention is to provide a cooling system for an internal

combustion engine which enables a higher pressure to be maintained in the engine cylinder than with systems heretofore proposed and which, while employing a circulating liquid as the cooling medium, may take advantage of the laws of vaporization and condensation in facilitating the cooling of the engine.

Another object of the invention is to provide a cooling system for an internal combustion engine of the type characterized which is simple in construction, inexpensive to manufacture and install, and efficient in operation. Other objects will appear as the description of the invention proceeds.

Stated broadly, the invention comprises, in a cooling system for an internal combustion engine, a radiator so constructed that the cooling medium traverses the radiator in the direction of a major dimension thereof one or more times before said medium is vented to the atmosphere and means, preferably automatic, whereby the cooling medium may be maintained substantially at a pre-determined temperature. Said radiator and automatic means may be desirably formed as a single radiator unit which may constitute a distinct article of manufacture.

The invention is capable of receiving a variety of mechanical expressions, several of which are shown on the accompanying drawings, but it is to be expressly understood that the drawings are for purposes of illustration only and are not to be construed as a definition of the limits of the invention; reference being had to the appended claims for that purpose.

Referring to the drawings wherein the same characters of reference are employed to designate corresponding parts in the several figures,—

Fig. 1 is a schematic elevation, partly in vertical section, of a cooling system for an internal combustion engine embodying the present invention.

Fig. 2 is an elevation, partly in vertical section, of another form of radiator which also embodies the present invention.

Fig. 3 is an elevation, partly in vertical section, of another type of radiator which also embodies the present invention.

Fig. 4 is a schematic elevation, partly in vertical section, of another type of cooling system for an internal combustion engine which also embodies the present invention.

Fig. 5 is an elevation, partly in vertical section, of still another form of radiator which embodies the present invention.

Fig. 6 is a face view, partly broken away, of a radiator of the honeycomb type constructed in accordance with the present invention.

Fig. 7 is a rear elevation, partly broken away, of a radiator embodying the present

invention and provided unitarily therewith with one form of automatic means for maintaining the cooling medium substantially at a pre-determined temperature.

Fig. 8 is a vertical section on the line 8—8 of the radiator shown in Fig. 7.

Fig. 9 is a horizontal section on the line 9—9 of Fig. 7.

Fig. 10 is a schematic elevation, partly in vertical section, of a cooling system for an internal combustion engine provided with the radiator and temperature controlling means disclosed more in detail in Figs. 7, 8 and 9.

In the form shown in Fig. 1, 1 is an internal combustion engine of any suitable construction and provided with a jacket through which a cooling medium is to be circulated. Leading from said jacket is a suitable outlet manifold 2 connected by a conduit 3 with a radiator 4. While the present invention may be employed in a cooling system wherein the circulation is maintained by the difference in density of said medium at different parts of the system, the construction illustrated comprises a pump 5 of any suitable construction connected to the outlet of the radiator by conduit 6 and to the inlet manifold 7 by conduit 8. The radiator 4 may be provided with the usual filling opening 9 and cap 10 and is shown as provided with the usual overflow or vent pipe 11 which opens into the interior of the radiator adjacent the top thereof. In operation the pump 5 withdraws cooling medium from the bottom chamber of the radiator through pipe 6 and delivers said medium to the jacket through the conduit 8 and inlet manifold 7. From the jacket the cooling medium flows through conduit 3 to the top chamber of the radiator 4 and, in the absence of the present invention, any vapor formed in the cooling medium by the heat abstracted from the engine cylinder may readily escape through the overflow pipe 11 and be lost.

In accordance with the present invention, said radiator is so constructed that the cooling medium must traverse the radiator in the direction of a major dimension thereof one or more times before coming into proximity to the inlet of said overflow pipe. To this end the radiator may be constructed in a variety of ways. In the form shown in Fig. 1, wherein the radiator is of the tube and fin type, the upper chamber of the radiator is divided into two compartments 12 and 13 by a suitable partition 14 and the conduit 3 is provided with an extension 15 which leads into the forward compartment 12. The bottom chamber of the radiator is also provided with a suitable partition 16 which divides said chamber into two compartments 17 and 18, the latter of which communicates with the return con-

duit 6. The vertical pipes 19 communicating with the upper and lower chambers of the radiator are divided into three groups, one of which connects the compartment 12 with the compartment 17, a second of which connects the compartment 17 with the compartment 13, and the third of which connects the compartment 13 with the compartment 18. Said radiator is, therefore, so arranged as to provide a passage which traverses the radiator a plurality of times and, as the overflow pipe 11 communicates only with the compartment 13, the cooling medium must traverse the radiator twice, in the form here shown, before the cooling medium is vented to the atmosphere. Therefore, before said cooling medium flows to a place where vapor may escape and be lost, said medium must traverse the radiator in the direction of a major dimension thereof and at an angle to the normal direction of air current flowing therethrough. Furthermore, the cooling fluid which has traversed the radiator once becomes mixed with a body of cooler liquid in a compartment where uncondensed vapor will be trapped and condensation facilitated. This arrangement of Fig. 1 possesses the further advantage that the hottest cooling medium entering the radiator is brought into contact with the coldest air passing through the radiator, because it first traverses a section of the radiator occupying the face thereof. Such an arrangement, however, is not essential for, as shown in Fig. 2, the cooling medium may be first subjected to more or less heated air and come into heat-interchanging relationship with cooler air as its own temperature is lowered in its flow through the radiator, conversely to the operation of the radiator shown in Fig. 1.

In the form shown in Fig. 2, the upper chamber of the radiator is divided by a partition 20 into compartments 21 and 22 and the lower chamber of the radiator is divided by a partition 23 into compartments 24 and 25. Conduit 3 communicates directly with compartment 21 while compartment 25 communicates with the return conduit 6. As in the construction of Fig. 1, the pipes 19 are divided into three groups respectively connecting the aforesaid compartments into a passage which traverses the radiator a plurality of times and, as the overflow pipe 11 communicates only with compartment 22, the cooling medium must traverse the radiator before it becomes vented to the atmosphere. In this arrangement, however, the hottest liquid flows downwardly through pipes at the rear of the radiator and progresses through pipes successively subjected to cooler air, instead of first being subjected to the coolest air as in the arrangement of Fig. 1.

In both the structures of Figs. 1 and 2,

the cooling medium is made to traverse the radiator twice before the same is vented to the atmosphere but, if desired, the cooling medium may be made to traverse the radiator a larger number of times before the same is vented to the atmosphere. In the form shown in Fig. 3, the radiator is provided with a passage which traverses the radiator three times by the same arrangement of partitions and tubes as shown in Fig. 1. The upper chamber of the radiator, however, is provided with a further partition 26 which separates the compartments 12 and 13 from a third compartment 27 from which the overflow pipe 11 leads. Said compartment 27 is connected by a pipe 28 with the compartment 18. Therefore, before vapor can escape to the overflow pipe, the cooling medium must have traversed the radiator three times and reach the compartment 18 and, as the inlet of the pipe 28 is normally sealed by the liquid in said compartment 18, only such vapor as bubbles up through the liquid in said pipe can escape through the overflow pipe.

The cooling system is also provided with means whereby the temperature of the cooling medium may be maintained substantially uniform, and said means is preferably made automatic in operation. Such temperature regulating means may take a variety of forms, that shown comprising thermostatic valve mechanism for regulating the flow of the cooling medium through the radiator, although an automatically-operated radiator curtain or shutters could be used if desired. Furthermore, in order that the cooling medium may be kept in circulation when the engine is running, a by-pass is preferably provided around the radiator and automatically controlled by said thermostatic valve mechanism. In the form shown in Fig. 1, a valve housing 28 is interposed between the outlet manifold 2 and the conduit 3 and also communicates through by-pass 29 with the return conduit 6. Said valve housing is provided interiorly with ports 30 and 31 which respectively communicate with the conduit 3 and the by-pass 29. Said ports are in turn controlled by suitable valves, here shown as seating valves 32, connected by stem 33 with a thermostat 34 of any suitable construction. Said thermostat is preferably subjected to the temperature of the cooling medium and, to that end, the valve housing is provided with an enlargement through which the cooling medium flows from the outlet manifold and in which said thermostat is positioned. In the embodiment illustrated, said thermostat takes the form of an expansible and collapsible corrugated vessel, preferably of a resilient material such as brass, and is charged with a volatile fluid. Said thermostat may be charged with the volatile fluid at a pressure below that to which the same is

normally subjected exteriorly so that the vessel is normally more or less collapsed by the exterior pressure acting thereon and has an inherent tendency to expand and operate the valve mechanism in the manner to be hereinafter explained.

In operation, when the engine is started, the cooling medium in the jacket is cold, thermostat 34 is contracted, and valves 32 are in a position wherein ports 30 are entirely closed and port 31 is wide open. The cooling medium is then forced by the pump 5 through the engine jacket and returned to the pump through by-pass 29. The small volume of cooling medium thus circulated quickly rises in temperature and, when the pre-determined temperature has been reached, thermostat 34 begins to expand, opening ports 30 and proportionately closing port 31. A portion of the cooling medium now flows through conduit 3 to radiator 4 and is returned to the pump through conduit 6. If the temperature continues to rise, ports 30 are opened wider and port 31 is further closed until all of the cooling medium is circulated through the radiator. Therefore, the thermostat will maintain the cooling medium at a substantially uniform temperature as it leaves the engine jacket and, even though this temperature be so high as to tend to cause volatilization of the cooling medium or any constituent thereof, the heated medium must traverse the radiator one or more times before it reaches a portion thereof where it is in open communication with the air. Thus, in the structure shown in Fig. 1, if the thermostat be set to maintain the cooling medium at 190° Fahrenheit—which is above the boiling point of alcohol—and the radiator be constructed to cool the medium to 100° Fahrenheit, said medium will traverse two-thirds of the passage through the radiator before it is vented to the atmosphere. It will therefore be reduced in temperature to at least 130° Fahrenheit at this latter point—which temperature is below the boiling point of alcohol—and condensation of all vapors created by passage of the cooling medium through the jacket is insured before any such vapor can escape and be lost.

If the thermostat 34 be constructed as hereinbefore described, so that it has a normal tendency to expand against the pressure to which it is exteriorly subjected, and if it springs a leak, with a resultant equalization of the internal and external pressures acting thereon, vessel 34, owing to its inherent resiliency, will close port 31 and open wide the ports 30 so that all of the cooling medium will be circulated through the radiator.

To facilitate filling and draining of the radiator and to prevent air or vapor pockets from forming in said radiator and prevent-

ing proper circulation of the cooling medium therethrough, the partitions dividing the upper and lower chambers of the radiator are preferably provided with small vent openings 35. Said vent openings are preferably so arranged that any vapor escaping therethrough will come in contact with a colder body of liquid and insure condensation of such vapor. Said vents 35 may be only small openings formed in the respective partitions, or they may be provided with manually operated valves or with automatically operated valves—such as float-operated valves—whereby they will open upon the formation of air or vapor pockets in any compartment.

While it is preferred that the cooling medium shall traverse the radiator a plurality of times, such is not essential to the invention in its broader aspects, as a radiator may be so constructed as to insure condensation of vapor during a single traverse of the radiator in the direction of a major dimension thereof before the same is vented to the atmosphere and the cooling medium then return to the jacket without further circulation through said radiator. Such an arrangement is illustrated in Fig. 4 wherein the radiator 4 is shown as provided with the usual overflow or vent pipe 11 opening into the interior of the radiator adjacent the top thereof and wherein said radiator is so connected with the jacket that the cooling medium flowing from said jacket is introduced into the bottom chamber 36 of the radiator through pipe 6 and withdrawn for return to the jacket from the upper chamber 37 of said radiator through the conduit 3. In this form all of the radiator tubes 19 communicate with both said chambers 36 and 37 and the cooling medium traverses the radiator but a single time. As said medium is vented to the atmosphere only after it has traversed the entire length of the radiator, however, loss of vapor through the overflow pipe 11 is insured against. While in this arrangement the direction of circulation of the cooling medium is from the bottom to the top of the radiator, such is not essential, as the circulation may exist from top to bottom if a construction similar to that illustrated in Fig. 3 be employed.

The embodiment of the invention shown in Fig. 4 also embraces a different arrangement of the automatic means for controlling the circulation of the cooling medium. In this arrangement the cooling medium is withdrawn from the jacket by pump 5 through manifold 7 and conduit 8 and, as heretofore explained, delivered to the bottom of the radiator through conduit 6, returning to the jacket from the top of the radiator through conduit 3 and manifold 2. As in the structure of Fig. 1, a by-pass 38 is provided around the radiator, said by-

pass being shown as communicating at its upper end with a coupling 39 intermediate the conduit 3 and manifold 2 and communicating at its lower end with a thermostat and valve housing 40 provided with ports 41 and 42. Ports 41 are controlled by valves 43, shown as seating valves, while port 42 is controlled, but never entirely closed, by the movable end wall of an expansible and collapsible vessel 44, suitably mounted in said housing as by a bracket, connected to said valves 43 and constituting a thermostat for operating said valve mechanism. Vessel 44 may be of the construction described more particularly in connection with vessel 34 shown in Fig. 1.

The operation of this embodiment of the invention is similar to that illustrated in Fig. 1 except that the direction of circulation of the cooling medium is reversed, the thermostat 44 responding to variations in temperature in the cooling medium and proportioning the flow of said medium between the by-pass and radiator so as to maintain said medium substantially at a pre-determined temperature.

The arrangement of the cooling system illustrated in Fig. 4 may also be employed in conjunction with a radiator through which the cooling medium is circulated a plurality of times, as shown in Fig. 5. The radiator here illustrated is provided with a partition 45 which divides the inlet or bottom chamber of the radiator into compartments 46 and 47 and a partition 48 which divides the outlet chamber of the radiator into compartments 49 and 50. The action of this radiator is similar to that shown in Fig. 1 except that the direction of circulation of the cooling medium is reversed.

When the cooling medium is made to traverse the radiator a plurality of times, it is not necessary that the successive sections of the passage through the radiator be arranged from front to rear of said radiator or vice versa. It is sufficient if the cooling medium be made to traverse the radiator in the direction of a major dimension thereof i. e. parallelly to the face of the radiator either vertically, horizontally or diagonally. Referring to Fig. 6, the invention is shown as embodied in a radiator of the honeycomb type and the successive sections of the radiator passage are arranged transversely of said radiator. In the construction here illustrated, the radiator 51 is provided with an inlet conduit 52, an outlet conduit 53 and the usual overflow or vent pipe 54 communicating with the interior of said radiator adjacent the top thereof. The upper chamber of the radiator is shown as provided with two partitions 55 and 56 which divide said chamber into compartments 57, 58 and 59. The lower chamber of said radiator is provided with a partition 60 which divides said

chamber into compartments 61 and 62. Cooling medium entering the radiator through conduit 52 is received in compartment 57 and compelled to traverse the radiator vertically to compartment 61, thence to compartments 58, 62 and 59 in succession, returning to the jacket through conduit 53. By this arrangement the cooling medium is made to traverse the radiator four times and as the overflow pipe communicates only with compartment 58, said medium must traverse the radiator twice before it is vented to the atmosphere. The partitions 55, 56 and 60 may be provided with vent openings for the purposes heretofore explained.

Means for automatically regulating the temperature of the cooling medium may be combined unitarily with a radiator embodying the present invention, as shown in Figs. 7, 8 and 9. In the structure here illustrated, the radiator 63 is provided with an overflow or vent pipe 64 which communicates with the interior thereof adjacent its upper end and has its bottom chamber provided with a partition 65 which divides said chamber into compartments 66 and 67. Unitarily mounted on said radiator in any suitable way is a valve and thermostat housing 68 provided with ports 69 and 70 controlled by valve members 71. Said valve members 71 are operatively connected to a thermostat 72 which may take the form of an expansible and collapsible corrugated vessel charged with a volatile fluid as heretofore explained. The interior of said housing 68 communicates with compartment 66 through an outlet 73, leading from the ports 69. The interior of said housing 68 is also in communication with inlet 74 connected with the conduit 75 which in turn communicates with the outlet manifold of the engine jacket. In the form here shown, inlet 74 is connected to said conduit 75 by a pipe 76 unitarily mounted on the rear of the radiator in any suitable way. The interior of said housing 68 is also in communication with a second outlet 77 which is connected through pipe 78 with conduit 79 which in turn is in communication with the inlet manifold of the engine jacket. In the form here shown, said pipe 78 is extended within the compartment 67 and has its end projecting within said conduit 79. Flow of the cooling medium through outlet 77 and pipe 78 is controlled by the coaction with port 70 of the adjacent valve member 71.

In this embodiment of the invention the cooling medium flows to the valve housing 68 from conduit 75 through pipe 76. When said medium is below a pre-determined temperature, thermostat 72 is contracted and maintains valve members 71 in contact with ports 69, while port 70 is wide open. The medium then flows from housing 68 through outlet 77 and pipe 78 to conduit 79. As the

temperature of the cooling medium rises, however, thermostat 72 expands and opens the ports 69, correspondingly closing port 70. Some of the cooling medium now flows through outlet 73 into compartment 66 from which it traverses the radiator to the upper chamber thereof, again traverses the radiator to compartment 67, and returns through conduit 79. When thermostat 72 is fully expanded the ports 69 are wide open and port 70 is entirely closed, whereby all of the cooling medium must circulate through the radiator. As said medium must traverse the radiator before reaching the upper water chamber thereof, with which the overflow pipe 64 communicates, condensation of vapor existing in said medium is insured before said medium is vented to the atmosphere.

It will therefore be perceived that a cooling system for internal combustion engines has been provided which, without the use of auxiliary condensing apparatus, insures that vapor formed in or from said medium as it passes through the engine jacket shall be condensed before it may escape to the atmosphere. It will further be perceived that a cooling system has been provided which enables the cooling medium to be maintained at a relatively high temperature, such as to insure the most efficient operation of the engine, without substantial loss by escape of vapor of any of the cooling medium or its constituents. In fact, the present invention enables the cooling medium in the engine jacket to be maintained at a temperature well above the boiling point of usual anti-freezing compositions without appreciable loss of such composition.

Furthermore, as the cooling medium is subjected to atmospheric pressure only after the same has traversed the radiator one or more times, a radiator constructed in accordance with the present invention tends to back up pressure in the jacket and the conduit leading therefrom. This increased pressure in the jacket tends to oppose volatilization of the cooling medium or its constituents but, as this pressure is reduced as the cooling medium approaches the radiator, volatilization may take place more readily, and the latent heat of vaporization supplied the vapor by the liquid cooling medium tends to facilitate the cooling thereof. The temperature difference between said vapor and the outside air being relatively great, rapid cooling is also facilitated. This utilization of the latent heat of vaporization enables the use of a smaller volume of cooling medium so that the liquid spaces in the jacket and radiator may be decreased and the surfaces of radiation proportionately increased. Therefore, certain of the advantages attendant on the use of the radiator as a condenser may be obtained without danger

of loss of the cooling medium and without the expensive construction heretofore necessary in cooling systems wherein the radiator functioned as a condenser. In fact, the engine jacket may be maintained at a temperature that will insure vaporization of the cooling medium provided that the radiator be so designed as to insure condensation of said vapor before it has traversed the radiator to that compartment which is in communication with the atmosphere through the overflow or vent pipe.

It will furthermore be perceived that a compact and simple radiator unit, which comprises a radiator arranged and constructed in accordance with the present invention and automatic means for regulating the cooling action of the system, has been provided in a single unitary structure that is available for installation either in systems already in use or in systems in course of construction.

While the embodiments of the invention illustrated on the drawings have been described with considerable particularity, it is to be expressly understood that the invention is not limited thereto as the same is capable of receiving a variety of mechanical expressions, some of which will readily suggest themselves to those skilled in the art while certain features thereof are capable of use without other features thereof. While the radiator has been shown as so constructed as to compel circulation of the cooling medium therethrough from one to four times, it is to be understood that, within the purview of the present invention, the cooling medium may be circulated through the radiator a larger number of times. Furthermore, it is to be understood that the position at which the cooling medium is vented to the atmosphere may vary so long as the cooling medium is made to traverse the radiator at least once in the direction of the major dimension thereof before coming into proximity to the overflow or vent opening, the number of times that the cooling medium is circulated through the radiator before the same is vented to the atmosphere varying in accordance with the extent to which the temperature of said medium is to be decreased before venting the same to the atmosphere. Reference is therefore to be had to the claims hereto appended for a definition of the limits of the invention.

What I claim is:

1. In a cooling system for an internal combustion engine, in combination with the engine jacket, a system for circulating a liquid cooling medium through said jacket including means for controlling circulation of the cooling medium through the system so as to maintain said medium in the jacket at a relatively high temperature at which

vapor may be formed therefrom and a radiator in communication with said jacket and constructed to cause the cooling medium to traverse the same at least once in the direction of a major dimension thereof before being vented to the atmosphere, whereby any vapor from said medium is condensed before it can escape.

2. In a cooling system for an internal combustion engine, in combination with the engine jacket, thermostatically means for regulating the flow of cooling medium through the system and adapted to maintain said medium at a relatively high jacket temperature at which vapor may be formed therefrom and a radiator in communication with said jacket constructed to condense any vapor formed from said cooling medium by causing said cooling medium to traverse the radiator at least once in the direction of a major dimension thereof before said vapor can escape to the atmosphere.

3. In a cooling system for an internal combustion engine, in combination with the engine jacket, a radiator in communication with said jacket, a by-pass around said radiator, and thermostatically controlled valve mechanism for regulating the circulation of cooling medium through said radiator so as to maintain said medium at a relatively high jacket temperature at which vapor may be formed therefrom, said radiator being constructed to cause the cooling medium to traverse said radiator at least once in the direction of a major dimension thereof and condense any vapor formed from said cooling medium before said cooling medium is vented to the atmosphere.

4. In a cooling system for an internal combustion engine, in combination with the engine jacket, a system for circulating a cooling medium through said jacket including means for controlling circulation of the cooling medium so as to maintain said medium at a relatively high temperature at which vapor may be formed in said jacket and a radiator in communication with said jacket constructed to cause the cooling medium to traverse said radiator a plurality of times in the direction of a major dimension thereof before any vapor can escape to the atmosphere.

5. In a cooling system for an internal combustion engine, in combination with the engine jacket, a system for circulating a cooling medium through said jacket including thermostatically means for regulating the flow of cooling medium adapted to maintain said medium at a relatively high temperature at which vapor may be formed in said jacket and a radiator in communication with said jacket constructed to condense any vapor formed from said cooling medium by causing said cooling medium to

traverse the radiator a plurality of times in the direction of a major dimension thereof before said vapor can escape to the atmosphere.

6. In a cooling system for an internal combustion engine, in combination with the engine jacket, a radiator in communication with said jacket, a by-pass around said radiator, and thermostatically controlled valve mechanism for regulating the circulation of cooling medium through said radiator so as to maintain said medium at a relatively high temperature at which vapor may be formed in said jacket, said radiator being constructed to cause the cooling medium to traverse said radiator a plurality of times in the direction of a major dimension thereof and condense any vapor formed from said cooling medium before said cooling medium is vented to the atmosphere.

7. In a cooling system for an internal combustion engine, in combination with the engine jacket, means in said system for controlling the circulation of the cooling medium so as to maintain the medium in said jacket at a relatively high temperature at which vapor may be formed therefrom, a radiator in communication with said jacket, and means in said radiator whereby the cooling medium must traverse the same one or more times in the direction of a major dimension thereof before any vapor can escape to the atmosphere, the passage for cooling medium through said radiator being so arranged that the cooling medium when first traversing the radiator is subjected to the coolest air flowing through the radiator.

8. In a cooling system for an internal combustion engine, in combination with the engine jacket, thermostatically means in said system for regulating the flow of cooling medium and adapted to maintain the medium in said jacket at a relatively high temperature at which vapor may be formed therefrom, a radiator in communication with said jacket, and means in said radiator whereby the cooling medium first traversing said radiator is subjected to the coolest air flowing through said radiator and said cooling medium must traverse said radiator one or more times in the direction of a major dimension thereof to condense any vapor formed in said medium before said vapor can escape to the atmosphere.

9. In a cooling system for an internal combustion engine, in combination with the engine jacket, a radiator in communication with said jacket, a by-pass around said radiator, thermostatically controlled valve mechanism for regulating the circulation of cooling medium through said radiator and by-pass, and means in said radiator whereby the cooling medium first traversing said radiator is subjected to the coolest air flowing through said radiator and the cooling

medium must traverse said radiator one or more times in the direction of a major dimension thereof before it is vented to the atmosphere.

5 10. A radiator unit for the cooling system of an internal combustion engine including a radiator shell, means in said radiator whereby the cooling medium must
10 traverse the same in the direction of a major dimension thereof one or more times before said medium is vented to the atmosphere, a housing mounted on said radiator shell and communicating therewith, an inlet conduit for said radiator leading to said
15 housing, an outlet conduit for said radiator communicating with said housing, and thermostatically controlled valve mechanism in said housing for determining whether the circulation shall be directly from said housing
20 ing to said outlet conduit or from said housing through said radiator.

11. A radiator unit for the cooling system of an internal combustion engine including a radiator shell, a housing mounted on said
25 radiator shell and communicating therewith, an inlet conduit for said radiator leading to said housing, an outlet conduit for said radiator communicating with said housing, and thermostatically controlled valve mechanism in said housing for determining
30 whether the circulation shall be directly from said housing to said outlet conduit or from said housing through said radiator.

12. A radiator unit for the cooling system
35 of an internal combustion engine including a radiator shell, a housing mounted directly on said radiator shell and communicating therewith, an inlet conduit for said radiator leading to said housing, an outlet conduit
40 for said radiator, and thermostatically controlled valve mechanism in said housing for regulating the circulation of cooling medium.

13. In a cooling system for an internal
45 combustion engine, in combination with the engine jacket, a system for circulating a liquid cooling medium through said jacket including means for controlling circulation of the cooling medium through said system
50 so as to maintain said medium at a relatively high jacket temperature at which vapor may be formed therefrom, a radiator in communication with said jacket, and an

overflow pipe communicating with said radiator so as to maintain said medium at atmospheric pressure adjacent to the inlet to
55 said pipe, said radiator being constructed to cause the cooling medium to traverse the same one or more times in the direction of a major dimension thereof before reaching the
60 inlet to said overflow pipe so as to condense vapors before they can escape through said pipe.

14. In a cooling system for an internal combustion engine, in combination with the
65 engine jacket, thermosensitive means for regulating the flow of cooling medium through the system and adapted to maintain said medium at a relatively high temperature at which vapor may be formed in said
70 jacket, a radiator in communication with said jacket, and an overflow pipe in communication with said radiator so as to maintain said cooling medium at atmospheric pressure adjacent the inlet to said pipe, said
75 radiator being constructed to condense any vapor formed from said cooling medium by causing said cooling medium to traverse the radiator one or more times in the direction of a major dimension thereof before reaching
80 the inlet to said overflow pipe.

15. In a cooling system for an internal combustion engine, in combination with the
85 engine jacket, a radiator in communication with said jacket, an overflow pipe in communication with said radiator so as to maintain the cooling medium at atmospheric pressure adjacent the inlet to said pipe, a by-pass around said radiator, and a thermostatically controlled valve mechanism regulating the circulation of cooling medium through said radiator and by-pass so as to
90 maintain said medium in said jacket at a relatively high temperature at which vapor may be formed therefrom, said radiator being constructed to cause the cooling medium to traverse said radiator one or more
95 times in the direction of a major dimension thereof and condense any vapor formed from said cooling medium before said cooling medium reaches the inlet to said overflow pipe.
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In testimony whereof I have signed this specification.

JEAN V. GIESLER.